AMENDMENTS TO THE CLAIMS

The following represents the complete listing of the claims in this application in the present state including any amendments sought to be entered at this time. Any claims canceled or withdrawn in this application are done so without prejudice or disclosure of any subject matter. Applicants reserve the right to pursue such claims in divisional or continuing applications. In this paper claim 4 is pending.

Listing of claims:

Claim 1-3 (canceled)

Claim 4 (new) A method of approximating an FIR filter with low-order linear-phase IIR filters by the rational Arnoldi algorithm with adaptive orders containing the following steps:

a) initialize the first vector of the Krylov sequence for each expansion point;

b) in the *j*th iteration of the algorithm, choosing an expansion frequency wherein the heuristics of selecting expansion frequencies in advance for the proposed rational Arnoldi method are given by

(a) low -pass filters: the proposed method with the expansion point $\omega_1 = 0$;

(b) high-pass filters: the special structures of state-space matrices used to present the duality between low-pass and light pass filters; let state matrices become $\overline{A} = -A$, $\overline{b} = b$, $\overline{c} = c$, and $\overline{h_0} = -h_0$, the expansion point $\omega_1 = 0$ chosen to perform the Arnoldi algorithm; when the corresponding orthonormal matrix $\overline{V}_q$ is obtained and then the high-pass IIR filter, which satisfies the same specifications as the original FIR filter; and

(c) band-pass/band-stop filters: the passband edge and the stopband edge frequencies being the appropriate candidate expansion points in meeting the

specifications of the design, and other expansion points with uniform spacing recommended to be selected

such that the frequency gives the greatest difference between the (j+1)st-order output moment of the original FIR filter H(z) and that of the lower-order IIR filter $\hat{H}$(z) wherein the expression of output moment errors between the $\hat{j}_i$ th-order moments $H^{(\hat{j}_i)}(z_i)$ and $\hat{H}^{(\hat{j}_i)}(z_i)$ at each expansion point z_i are expressed as follows:

$$|H^{(\hat{j}_i)}(z_i) - \hat{H}^{(\hat{j}_i)}(z_i)| = |h_\pi c^T r^{(\hat{j}_i - 1)}(z_i)|,$$

where $h_\pi(z_i) = \prod_j \left\| r^{(j-1)}(z_i) \right\|$ is the normalization coefficient when an expansion frequency z_i is selected in the jth iteration; vector c contains the last n impulse response coefficients of a FIR filter with length n+1; and $r^{(j-1)}(z_i)$ is the residual vector in the (j-1)st iteration of the disclosed adaptive rational Arnoldi algorithm at the expansion frequency z_i;

c) after the choosing the expansion point in jth iteration being determined, the single-point Arnoldi method applied at the expansion point to generate the new orthnormal vector; and

d) determine a new residual at each expansion point for next iteration;

whereby, after the giving total iteration number of the algorithm, outputting the resulting orthogonal projection matrix.